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Five lichens of *Leptogium* new to China

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Abstract—Three lichen species are recorded as new to China: *Leptogium furfuraceum*, *L. hibernicum*, and *L. papillosum*. *Leptogium arisanense* and *L. burnetii* are also reported as new to mainland China.

Key words—Tibet Plateau, Qinling Mountains, taxonomy

Introduction

Leptogium (Ach.) Gray is a subcrustose to foliose and gelatinous lichen genus belonging to *Collemataceae*, *Peltigerales*, *Ascomycota* (Miadlikowska & Lutzoni 2004). The genus is characterized by having the cyanobacterium *Nostoc* as primary photobiont, a homoiomerous corticated thallus and laminal zeorine apothecia, the septate, usually submuriform to muriform ascospores, and the absence of lichen substances (Sierk 1964, Jørgensen 1973, 1975, Galloway 1999). The genus comprises about 189 species worldwide (Kirk et al. 2008). In China, *Leptogium* includes 26 species, of which 15 species are found in mainland China and 20 species in Taiwan (Wei 1991, Jørgensen 1997, Lai 2000, Aptroot et al. 2002). During our study of this genus in China, three species new to China and two species new to mainland China were discovered, namely *L. furfuraceum*, *L. hibernicum*, *L. papillosum*, *L. arisanense* and *L. burnetii*. The thalli of all five species have tomentum. All the *Leptogium* species with tomentum have been summarized by Jørgensen (1997).

In addition, Jiang (1994) described three species new to science from China, *L. xiaowutaicum*, *L. hebeiense*, and *L. yunnanense*. However, the type specimens of these three species were not found in the mentioned Herbaria (HBNU and HMAS-L). According to the description by Jiang (1994), we

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think that *L. xiaowutaicum* represents *L. menziesii*, and *L. hebeiense* should be *L. saturninum*. Because most specimens collected by us from the type locality of *L. xiaowutaicum* and *L. menziesii* belong to *L. menziesii* or *L. saturninum* and the necessary description of *L. yunnanense* is lacking, we have not included the three new species reported by Jiang (1994) in our study.

Material and methods

The specimens studied are housed in SDNU (Shandong Normal University) and HMAS-L (Lichen Section, Herbarium of the Institute of Microbiology, Academia Sinica). The morphology and anatomy of lichen specimens were examined using a stereo (Motic K-400L) and light (JNOEC XS-213) microscope. An AO Histostat Microtome was routinely used for frozen sections. Photographs were taken with Olympus Cover-018.

New records

1. Leptogium ***furfuraceum*** (Harm.) Sierk, Bryologist 67: 266 (1964).

Thallus 2.5–4.5 cm in diameter, foliose, corticolous, loosely attached; upper surface brown when dry, with distinct wrinkles, somewhat shiny; lobes orbicular, about 1 cm broad, the margins entire and somewhat undulate, commonly turning under; isidia cylindrical to clavate with a minute pit in the apex, brown, sometimes shiny; lower surface covered with white tomentum. Lobes 75–300 μm thick; cortex cells on both sides, 7.5–10 μm in diameter; nostoc-cells spherical to elongate, 3.5–5 μm in diameter, in chains throughout thallus, but most abundant near the upper cortex; hyphae 2–3 μm in diameter, irregularly and loosely interwoven; hairs composed of cylindrical cells, 6–7 μm in diameter, longer than 100 μm.

Apothecia not seen.

Comments —*Leptogium furfuraceum* is closely related to *L. pseudofurfuraceum*. Both species have a brown thallus, densely wrinkled upper surface, and cylindrical to clavate isidia with a minute pit in the apex. However, *L. furfuraceum* can be separated from *L. pseudofurfuraceum* by the darker colored, more densely wrinkled upper surface and smaller spores. In addition, *L. pseudofurfuraceum* is primarily restricted to North America, while *L. furfuraceum* is nearly cosmopolitan.

L. furfuraceum has been reported from Europe, Africa, North America, and India (Sierk 1964, Awasthi & Akhtar 1977, Jørgensen 1997, Aragón et al. 2005). New to China.

Specimen examined: CHINA. **Yunnan**, Shangri-la County, alt. 3500 m, on bark, Z.J. Ren, 3 Nov. 2008 (SDNU: 20082160-1).

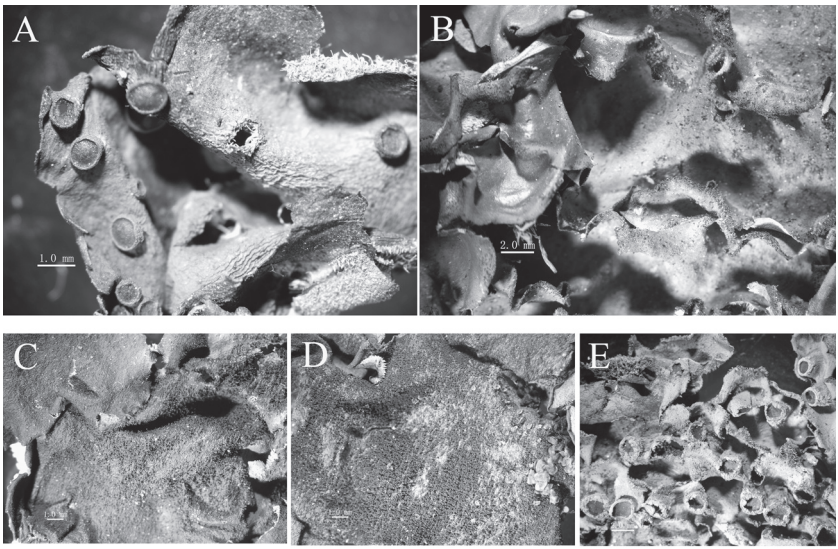

Fig. 1. *Leptogium* species examined in the present study. A. *L. arisanense*, QL590 X.L. Shi & S.X. Guo (SDNU); B. *L. burnetii*, 20080433-2 Z.J. Ren (SDNU); C. *L. furfuraceum*, 20082160-1 Z.J. Ren (SDNU); D. *L. hibernicum*, SH139 X.L. Shi & S.X. Guo (SDNU); E. *L. papillosum*, 031557 J.D. Zhao & L.W. Xu (HMAS-L). Scale bars: A,C,D = 1mm; B,E = 2 mm.

2. *Leptogium hibernicum* M.E. Mitch. ex P.M. Jørg., Herzogia 2: 462 (1973).

Thallus 2–3.5 cm in diameter, foliose, corticolous, loosely attached; upper surface blue grey when dry, with striate wrinkles, not glossy; lobes orbicular, about 1cm broad, the margins entire to somewhat undulate, commonly turning under; isidia laminal, granular to subcylindrical, commonly branching or sometimes squamulose, somewhat darker than thallus; lower surface covered with pale tomentum. Lobes 280–350 μm thick; upper cortex cells 3–4 μm in diameter, lower cortex cells 4.5–7 μm in diameter; nostoc-cells in chains throughout thallus, spherical to ellipsoidal, 2.5–4 μm in diameter; hyphae 2–3 μm in diameter, loosely interwoven; hairs composed of spherical cells, 5–6 μm in diameter, shorter than 30 μm.

Apothecia not seen.

Comments —Most *Leptogium* species with tomentum have long hairs with cylindrical cells except *L. hibernicum* and *L. laceroides*. Although both those species have short hairs with spherical cells, *L. hibernicum* can be distinctly separated from *L. laceroides* by the striate rather than smooth upper surface, the thicker thallus (280–350 μm cf. 80–120 μm), the broader lobes (1–1.5 cm cf. 0.3–0.6 cm), and the laminal rather than marginal and laminal isidia.

L. hibernicum has been reported from Europe, Africa, North America, South America, W. Indies, and New Guinea (Jørgensen 1975 1997, Aragón et al. 2005). New to China.

Specimen examined: CHINA. **Shaanxi**, Ningshan County, alt. 1500 m, on bark, S.X. Guo & X.L. Shi, 28 Jul. 2005 (SDNU: SH139); C.L. Wang & F. Yang, 27 Jul. 2005 (SDNU: NSW030).

3. *Leptogium papillosum* (B. de Lesd.) C.W. Dodge, Ann. Missouri Bot. Gard. 20: 422 (1933).

Thallus 5.5–7 cm in diameter, foliose, saxicolous, loosely attached; upper surface gray to bluish gray when dry, with distinct wrinkles; lobes irregular, orbicular, about 1 cm broad, the margins entire to crenate and isidiate, sometimes turning under; isidia laminal or sometimes marginal, semiglobular to clavate, sometimes wrinkled, simple or irregularly branched, concolorous with the thallus; lobules present, laminal; lower surface covered with pale brown tomentum. Lobes 120–160 μm thick; upper cortex 5–6 μm thick, lower cortex 7.5–9 μm thick; nostoc-cells in chains throughout thallus, spherical to ellipsoidal, 3–7.5 μm in diameter; hyphae 2.5–3.5 μm in diameter, loosely interwoven; hairs composed of cylindrical cells, 6–7 μm in diameter, about 200 μm long.

Apothecia frequent, laminal, stipitate, 1–3 mm in diameter; the disc concave, brown to red-brown; exciple thalline, with white hairs, concolorous with the thallus, margin usually with isidia; the euparaplectenchymatous layer above the cyanobiont layer 75–85 μm thick; spores 8, muriform, ellipsoid, 25–30 × 9–11 μm, 3–4-septate transversely, 1-septate longitudinally.

Comments —*Leptogium papillosum* is similar to *L. pseudopapillosum*. These two species both have a bluish gray thallus with isidia and dense wrinkles. However, *L. papillosum* can be separated from *L. pseudopapillosum* by the clavate rather than coralloid isidia, the thinner thallus (up to 160 μm cf. up to 400 μm), and the abundant (rather than very rare) apothecia. Although *L. papillosum* is usually corticolous, the Chinese specimen reported here is saxicolous.

Leptogium papillosum has been reported from North America, South America, and India (Awasthi & Akhtar 1977, Jørgensen 1997, Jørgensen & Nash 2004). New to China.

Specimen examined: CHINA. **Anhui**, Mt. Huangshan, alt. 630 m, on rock, J.D. Zhao & L.W. Xu, 27 Aug. 1962 (HMAS-L: 031557).

4. *Leptogium arisanense* Asahina, J. Jap. Bot. 12: 252 (1936).

Thallus 2.5–3.5 cm in diameter, foliose, corticolous, flat, spreading, loosely attached; upper surface bluish grey when dry, not glossy, with distinct wrinkles; lobes orbicular, discrete, 0.6–1 cm broad, the margins entire, regular to wavy;

isidia absent; lower surface covered with white tomentum. Lobes 100–210 μm thick; cortex cells on both sides 6–10 μm in diameter; nostoc-cells spherical to elongate, 5–7 μm in diameter, in chains throughout thallus; hyphae 3–4 μm in diameter, irregularly interwoven; hairs longer than 100 μm, composed of cylindrical cells, 4–6 μm in diameter.

Apothecia frequent, submarginal to laminal, sessile, 1–2 mm in diameter; the disc concave to convex, orange-brown to red-brown; exciple thalline, irregularly to periclinally wrinkled, concolorous with the thallus, usually with moderately hairs; the euparaplectenchymatous layer above the cyanobiont layer 25–30 μm thick; spores 8, muriform, ellipsoid, 24–29 × 9–12.5μm, 4–6 septate transversely, 1–2 septate longitudinally.

Comments —*Leptogium arisanense* is characterized by the distinctly wrinkled bluish grey thallus and the sessile apothecia with long marginal hairs.

Leptogium arisanense has been reported from India, New Guinea, and Taiwan (China) (Awasthi & Akhtar 1977, Jørgensen 1997). New to mainland China.

Specimen examined: CHINA. **Shaanxi**, Mt. Taibaishan, alt. 2070 m, on bark, X.L. Shi & S.X. Guo, 2 Aug. 2005 (SDNU: QL590).

5. *Leptogium burnetii* C.W. Dodge, Beih. Nov. Hedw. 12: 120 (1964).

Thallus 3–8 cm in diameter, foliose, corticolous, loosely attached; upper surface bluish gray when dry, glossy and obviously shiny; lobes orbicular, 1–2 cm broad, margins sometimes crenate; isidia abundant, mainly laminal, cylindrical to coralloid, slightly darker than the thallus; lower surface covered with white tomentum. Lobes 90–125 μm thick; upper cortex 5–7 μm thick, lower cortex 8–12 μm thick; nostoc-cells usually spherical, 4.5–6 μm in diameter, in chains throughout thallus, but most abundant near the upper cortex; hyphae 3–4.5 μm in diameter, irregularly interwoven; hairs with cylindrical cells, 6–7 μm in diameter, usually 150–250 μm long.

Apothecia not seen.

Comments —*Leptogium burnetii* is superficially similar to *L. saturninum*, but the former can be readily distinguished by the crenate, rather than entire lobes, and the cylindrical coralloid, rather than granular, isidia.

L. burnetii has been reported from North America, South America, Europe, Africa, Russia, Pakistan, Hawaii, Japan, and Taiwan (China) (Aragón at al. 2004, 2005). New to mainland China.

Specimen examined: CHINA. **Yunnan**, Shangri-la County, alt. 3500 m, on bark, Z.J. Ren, 3 Nov. 2008 (SDNU: 20081365, SDNU: 20082160); **Sichuan**, Litang County, alt. 4200 m, on bark, 5 Nov. 2008, Z.J. Ren (SDNU: 20080433-2), H.Y. Wang (SDNU: 20080541), Z.S. Sun (SDNU: 20080638); Mt. Gongga, alt. 1900–2100 m, on bark, X.Y.

Wang et al., 5 Aug. 1982 (HMAS-L: 031726, HMAS-L: 031728); **Hunan**, Sangzhi County, alt. 1380–1500 m, on bark, J.B. Chen et al., 20 Aug. 1997 (HMAS-L:031562, HMAS-L: 031564, HMAS-L: 031571); **Hubei**, Mt. Shennongjia, alt. 1900 m, on bark, J.B. Chen, 8 Sep. 1984 (HMAS-L: 031440).

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